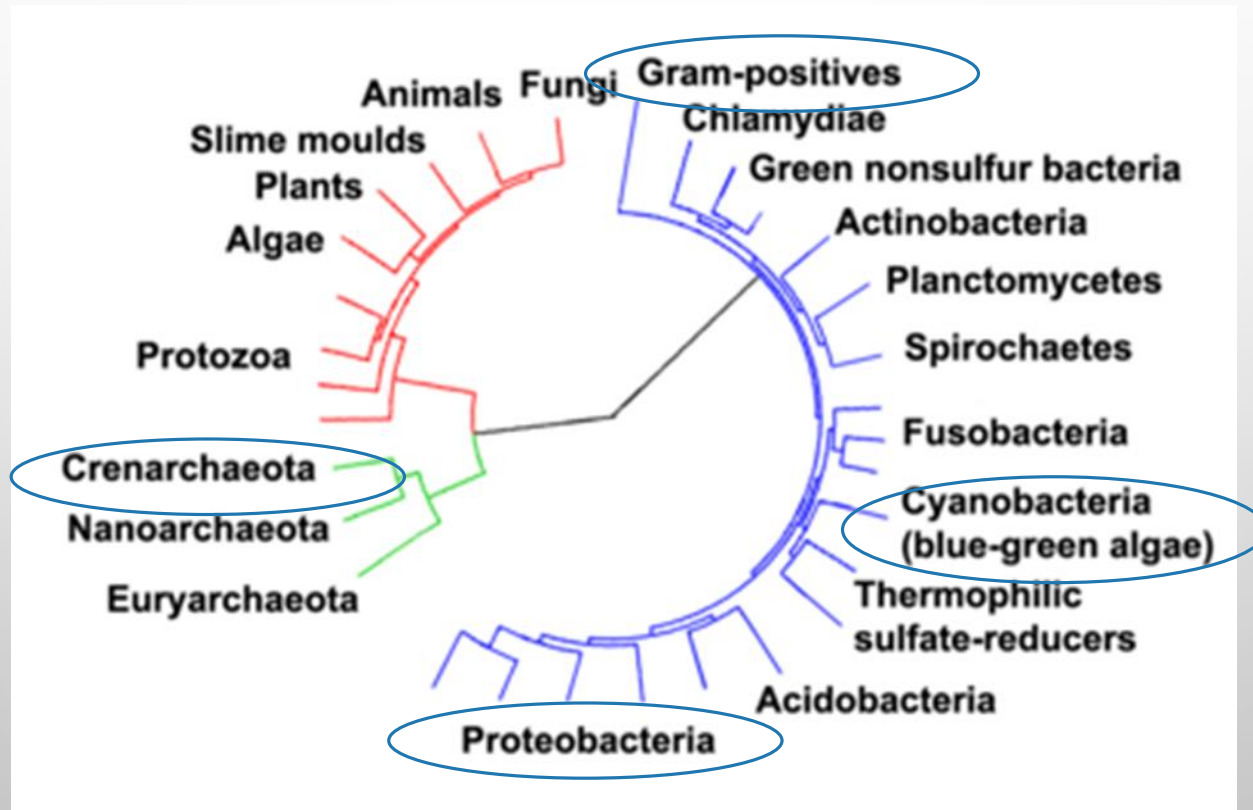


3.4 EUBACTERIA AND ARCHAEBACTERIA

Outline of Topics

1. Classification and Phylogeny
2. Characteristics and Reproduction
3. Harmful and Helpful Bacteria

CLASSIFICATION AND PHYLOGENY



IMPORTANT GROUPS TO KNOW:

EUBACTERIA:

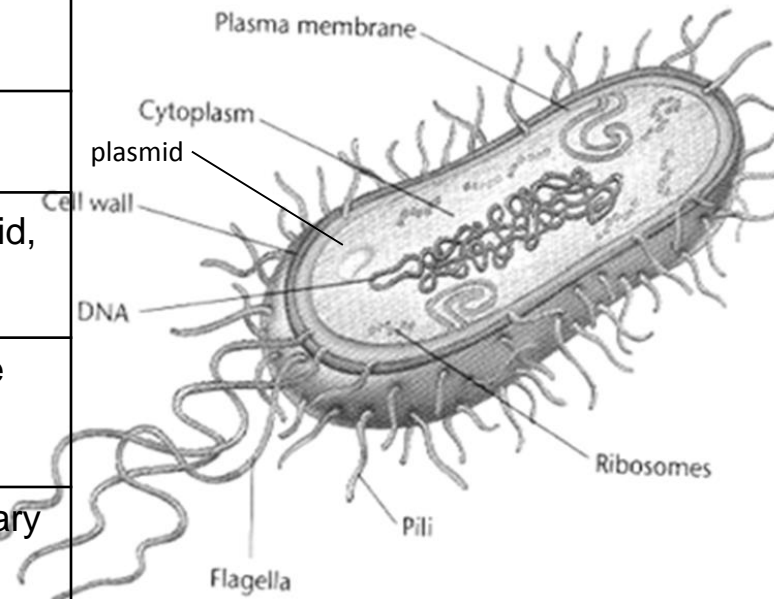
- **PROTEOBACTERIA** - ANCESTORS OF MITOCHONDRIA
- **CYANOBACTERIA** - ANCESTORS OF CHLOROPLASTS
- **GRAM POSITIVE BACTERIA** – COMMONLY SEEN AS BOTH HELPFUL AND HARMFUL BACTERIA

ARCHEAE (OF EURYARCHAEOTA):




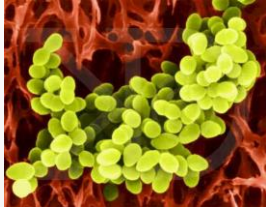


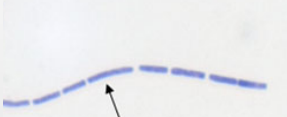

- METHANOGENS
- HALOPHILES
- EXTREME THERMOPHILES
- PSYCHROPHILES

CHARACTERISTICS OF EUBACTERIA

PART	Description and Function
Pili	Small hair-like structures that help bacteria adhere to other cells and surfaces
Flagellum	Whip-like tails used to propel bacteria
Capsule	Sticky material to reduce water loss, resist high temp. and block Ab and viruses
Cell Wall	Mostly composed of peptidoglycan to create rigid, protective cell wall
Cell Memb.	Plasma membrane, forms a barrier between the cell and its environment, allows selective movement of material in and out
Chromosome	Large ring of genetic information (DNA) necessary for normal cell function, found in nucleoid
Plasmid	Very small loop of DNA, can carry genes that provide resistance to Ab
Ribosome	Bead-like structures that 'convert' the information from DNA to make proteins
Cytoplasm	Fluid-filled space within the cell membrane



BACTERIA CAN BE CLASSIFIED BY THEIR SHAPE:

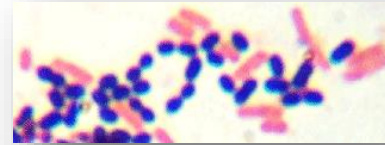
Shape	Single	Pairs	Chain	Clusters
Round	<p>Coccus</p> 	<p>Diplococcus</p> 	<p>Streptococcus</p> 	<p>Staphylococcus</p> 
Rod	<p>Bacillus</p> 	<p>Diplobacillus</p> 	<p>Streptobacillus</p> 	
Spiral	<p>Spirillum</p> 			

Gram +

- thick protein layer that stains purple
- more susceptible to antibiotics
- many are disease-causing

Gram –

- thin protein layer that stains pink
- has other material in the complex layered c.w. that block antibiotics.



What are the reasons for their success?

1. Prokaryotes have tremendous diversity in their metabolism.

Some are autotrophic – produce organic molecules from simple inorganic molecules.

Most are heterotrophic – use organic molecules formed by other organisms (bacteria that obtain carbon from dead organisms are called saprotrophs)

Energy can be derived from organic chemicals such as sugar, fats, and proteins. Bacteria can also use inorganic chemicals such as hydrogen, sulfur and iron cmpds for energy!

2. They can live with or without O_2 : a. obligate aerobe (like animals and plants) must have oxygen available, b. facultative aerobe can live with or without O_2 . c. obligate anaerobes cannot live in the presence of oxygen.

3. They occupy every ecological niche (recall from Grade 9)

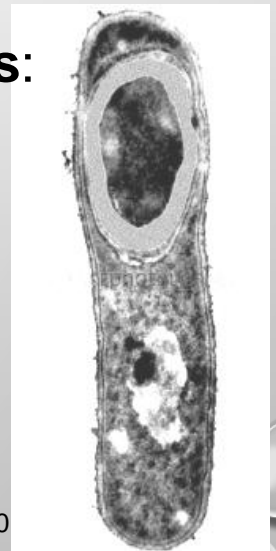
- **Producers**

- **Decomposers**

- Some form **symbiotic** relationships (includes mutualism, commensalism and parasitism)

4. They can form protective encasements called **endospores**:

In unfavourable environmental conditions the bacteria will condense the chromosome and other cellular components necessary for survival and encase it in a highly resistant wall. The remaining cellular components fall away, leaving the small, dormant endospore that can withstand extreme environments for long periods of time.



Sept 20

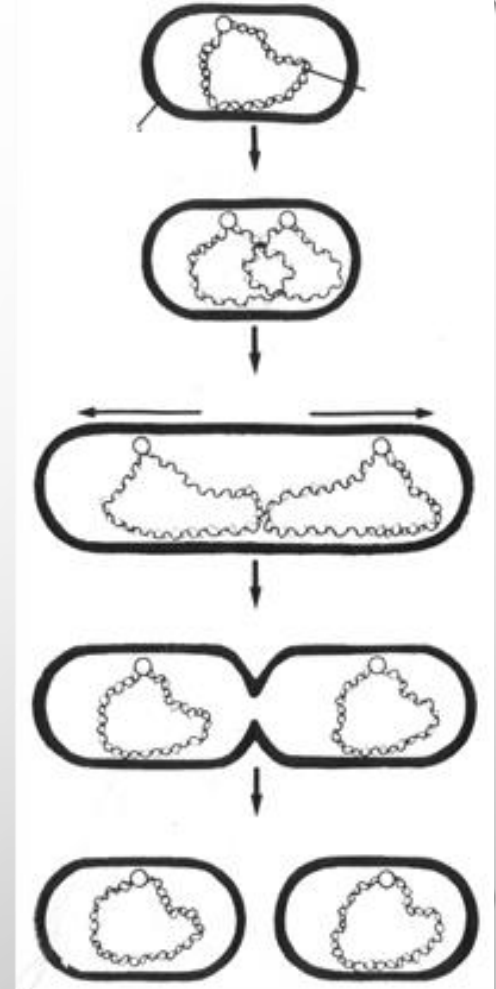
REPRODUCTION IN BACTERIA

1. **ASEXUAL REPRODUCTION** – BY BINARY FISSION

A PARENT CELL PRODUCES TWO DAUGHTER CELLS THAT ARE EXACT COPIES OF THE PARENT CELL. THE CHROMOSOME AND PLASMID REPLICATE, THE CELL ELONGATES, A SEPTUM OR WALL DIVIDES THE CELL, FOLLOWED BY CYTOKINESIS. ERRORS IN DNA REPLICATION CREATE MUTATIONS, THIS PROVIDES GENETIC DIVERSITY.

 [BINARY FISSION ANIMATION](#)

 [RATE OF BINARY FISSION VIDEO](#)

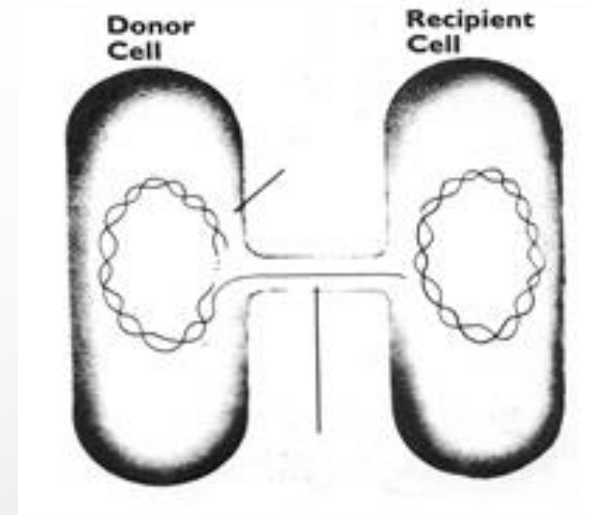


SEXUAL REPRODUCTION – DNA is exchanged between two individuals.

2. CONJUGATION:

Two cells share genetic information when one cell copies a gene from one plasmid and transfers it to a second cell. The DNA transfer is initiated through connecting pili.

[anim](#)



3. TRANSFORMATION: • A whole strand of DNA is transferred from a dead bacteria to a living one.

- Physical contact is not required.
- Also called horizontal gene transfer.
- Newly “transformed” bacteria can now perform functions of dead bacteria. Ex. could now become pathogenic (disease-causing).

HARMFUL AND HELPFUL BACTERIA

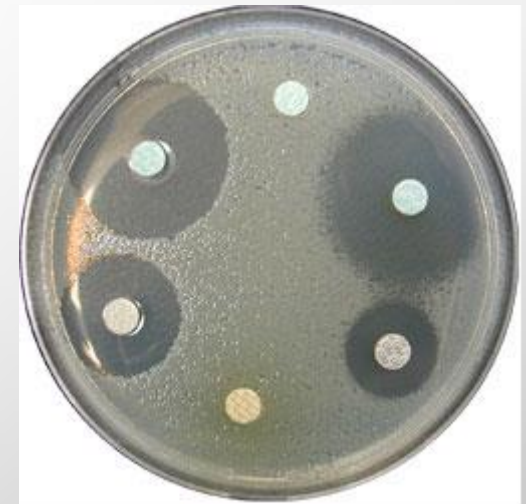
Bacterial Diseases:


Ex. Diphtheria, cholera, tetanus, leprosy, strep throat, tuberculosis, botulism, potato ring rot.

Read in your text how *E. coli* can become deadly!

Antibiotics can be used to kill bacteria. They are chemicals produced by certain strains of bacteria and fungi.

They were first discovered by accident by **Alexander Fleming** in 1929 when he examined a contaminated petri dish. The mould *Penicillium* was releasing a toxin that was inhibiting the growth of bacteria in the petri dish. He called the substance **penicillin**.



Antibiotics will save human lives but also have their drawbacks: they can kill helpful bacteria in your system, and if misused will lead to the development of  **antibiotic resistant bacteria**.

BENEFITS:

- ACT AS DECOMPOSERS AND PRODUCERS, ALSO VALUABLE IN THE NITROGEN AND CARBON CYCLES.
- DEVELOP MUTUALISTIC RELATIONSHIPS - EX. IMPORTANT IN DIGESTIVE SYSTEMS OF ANIMALS – PRODUCE MANY VITAMINS FOR THE HOST.
- FOOD PREPARATION: CHEESE, YOGURT, PICKLES, SOYSAUCE, VINEGAR, WINE.
- CHEMICAL MANUFACTURING
- PRODUCE ANTIBIOTICS

THE DOMAIN ARCHAEA

- IMPORTANT BUT NOT WELL UNDERSTOOD GROUP OF PROKARYOTES
- FOUND IN A VARIETY OF HABITATS INCLUDING EXTREME ENVIRONMENTS AND THE INTESTINES OF MAMMALS.
- HAVE UNIQUE CELL MEMBRANES (MOST LACK PEPTIDOGLYCAN - FORMS A MESH-LIKE LAYER OUTSIDE PLASMA MEMBRANE OF MOST BACTERIA), CELL WALLS AND GENETIC INFORMATION
- ASEXUAL REPRODUCERS
 - THEY USE:
 - BINARY FISSION,
 - BUDDING OR
 - FRAGMENTATION.

CHARACTERISTICS OF ARCHAEA

HAVE PROKARYOTIC CHARACTERISTICS EXCEPT:

- LARGE RIBOSOMES, LIKE EUKARYOTES
- CHEMICALLY DISTINCT CELL WALL (NOT LIKE EUBACTERIA, PLANTS OR FUNGI)
- VERY DIFFERENT GENE SEQUENCES
- LACK IMPORTANT CARBOHYDRATE FOUND IN CELL WALLS (GRAM -)
- HAVE DIFFERENT LIPIDS IN THEIR CELL MEMBRANE
- COME IN MANY SHAPES SUCH AS SPHERES (COCCI), RODS (BACILLI), SPIRALS (SPIRILLI) AND PLATES.
- MAY OR MAY NOT HAVE FLAGELLA (MOVEMENT) ☐

EVOLUTION AND ARCHAEA

- HOW COULD LIFE BEGIN IN AN ANAEROBIC ATMOSPHERE WITH WATER VAPOUR, METHANE AND AMMONIA?
- ARCHAEA ARE THOUGHT TO HAVE BEEN ONE OF THE EARLIEST FORMS OF LIFE TO EVOLVE ON OUR PLANET.
- FOSSILIZED REMAINS OF ARCHAE HAVE BEEN DATED TO 3.5 BILLION YEARS AGO!
- WERE THEY THE FIRST LIVING THINGS??